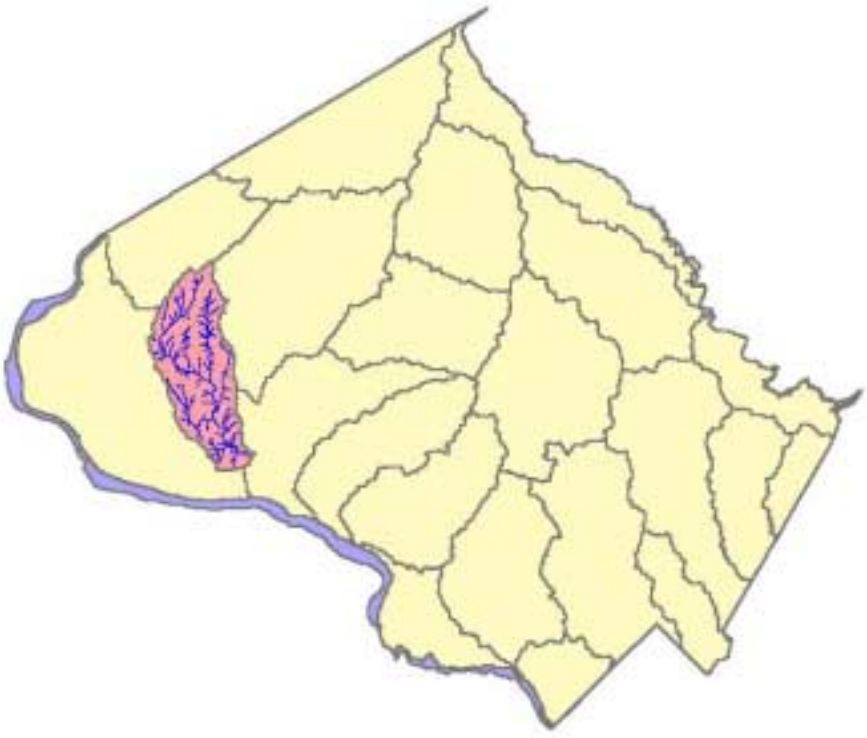
# *Dry Seneca Creek*

# *Watershed Study*

***Montgomery County MD***
Department of Environmental Protection
Watershed Management Division

February 27th, 2001



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## *I. Executive Summary*

The purpose of this report is to:

- *assess the existing stream conditions of the Dry Seneca Creek watershed,*
- *identify stream reaches with impairment from other than habitat stressors,*
- *identify stream reaches with unstable habitat features that, if left alone, could further degrade the biological community of the stream,*
- *provide recommendations for follow up actions concerning the identified areas of impaired stream reaches.*

Overall, most stations (9 out of 11) in the Dry Seneca watershed are **not** "impaired", and can be classified in the "good" condition. Most stations received a "good" to "excellent" fish IBI rating, and a "fair" to "good" macroinvertebrate IBI rating, all with corresponding "good" habitat ratings. The only major water quality and quantity stressor for these "unimpaired" streams seems to be the impacts from the drought of 1999. No stations sampled are **severely** entrenched, eroded, or void of instream habitat, that renders a priority subwatershed designation for instream restoration.

Two Dry Seneca stations are given the "impaired" designation due to severe impacts to water quality and aquatic biota (non-habitat stressors):

1. DSDS307. This station received a "poor" macroinvertebrate and fish IBI score, along with one of the lowest combined habitat scores. These low scores are most likely due to impacts of runoff from the town of Poolesville, and the Poolesville WWTP outfall located approximately 100 meters upstream of the station. Possible sanitary overflow from the WWTP outfall was observed by DEP staff during the spring sampling period.

2. DSDS214. This station received a "poor" macroinvertebrate and fish IBI score, along with the lowest combined habitat score. These low scores are most likely a result of the current land use practices in the drainage area. The Lewis Orchards property is located within, and upstream of the station. Individual habitat parameters indicate an excess of sediment in the stream, which may be discharging from a large farm pond on the Lewis property. Sediment may have accumulated in this pond throughout the years and is now being discharged at a rapid rate into the stream during storm events. This water quality impact probably explains the poor biology and habitat recorded at this station.

For station DSDS307, it is recommended that further water quality analysis be performed on the WWTP outfall. For station DSDS214, it is recommended that a MCDEP biologist and a NRCS staff member further investigate the site to determine the severity of the problem, and identify possible solutions.

## *II. Introduction to the Watershed (excerpted from the Countywide Stream Protection Strategy)*

Dry Seneca Creek, originating south of Barnesville, is a large tributary to Great Seneca Creek. The towns of Beallsville and Poolesville are located on the western edge of the drainage and influence conditions in Upper Dry Seneca and Russell Branch. Stream conditions in Dry Seneca are generally good, although, habitat conditions tend to be influenced by excessive levels of sediment deposition. Change has come to the upper reaches as the town of Poolesville has grown. Imperviousness area for the entire watershed is still below 10% (Figure 1). A newly designed wastewater treatment plant (WWTP), brought on-line in 1988, has overflowed several times into Dry Seneca, however, this is not expected to be a recurring problem.

The watershed remains in primarily agricultural land uses, with the exception of developed areas within the town of Poolesville. The dominant land use is primarily cropland, followed by woods and pasture (Figure 2). This land cover is equivalent between the upper and lower sections of the watershed (Figure 3). Large lot residential uses within the agricultural preserve are beginning to appear across the area, although significant changes in land use are not anticipated. A drive along Montevideo Road above Poole's Store crosses an old metal span bridge over a County stream that flows much as it has for the last hundred years; this is the Dry Seneca Creek.

The upper reaches of Dry Seneca contain forested tributaries that have been investigated in 1997 for potential inclusion into the County's reference stream database. This watershed includes a north to south transition in geologic character. In the southern part of the watershed, the streambed has cut down to reveal blocks of red sandstone bedrock. The fish community includes large populations of central stonerollers which feed on the algae coating these sandstone blocks. This is also one of the very few County watersheds where the eastern silvery minnow is found.

### ***Monitoring Stations***

Eleven Dry Seneca Creek monitoring stations were randomly selected and monitored in the year 2000 (Figure 4) by the Department of Environmental Protection, with cooperation from the Maryland National Capital Park and Planning Commission. The stations DSDS206, DSDS207, DSDS208, DSDS303, DSDS305, DSDS306, and DSDS307 are all within the Upper Dry Seneca subwatershed. Stations DSDS206 and DSDS207 are located on the Four Streams Golf Course property off of Darnestown Road in Beallsville. Station DSDS208 is located just outside of Poolesville town limits, upstream of Cattail Road. Station DSDS303 is located just outside of Poolesville town limits, upstream of Jerusalem Road. Stations DSDS305 and DSDS306 are located in Poolesville, just off of Doctor Walling Road. Station DSDS 307 is located just outside of Poolesville town limits, downstream of the Waste Water Treatment Plant. Station DSDS214 is within the Peach Tree Tributary subwatershed, and is located upstream of Darnestown Road on Lewis Orchards Property. Station DSDS220 is within the Darnall Tributary subwatershed, and is located upstream of Whites Ferry Road. Station DSRB207 is within the Russell Branch subwatershed, and is located off of Partnership Road. DSDS313 is within the Lower Dry Seneca subwatershed, and is located upstream of Sugarland Road.

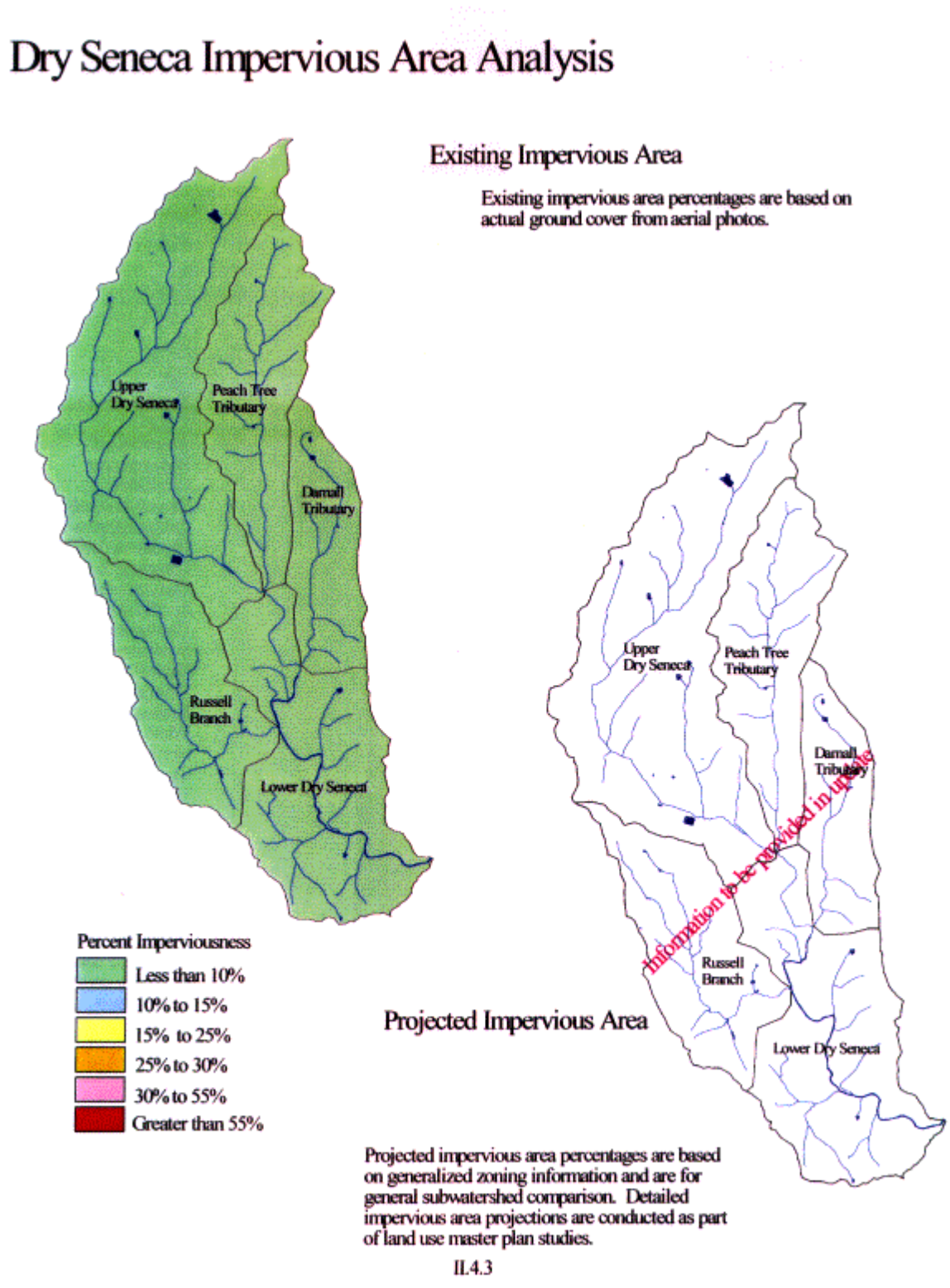


Figure 1. Impervious Percentage of Dry Seneca Subwatersheds.

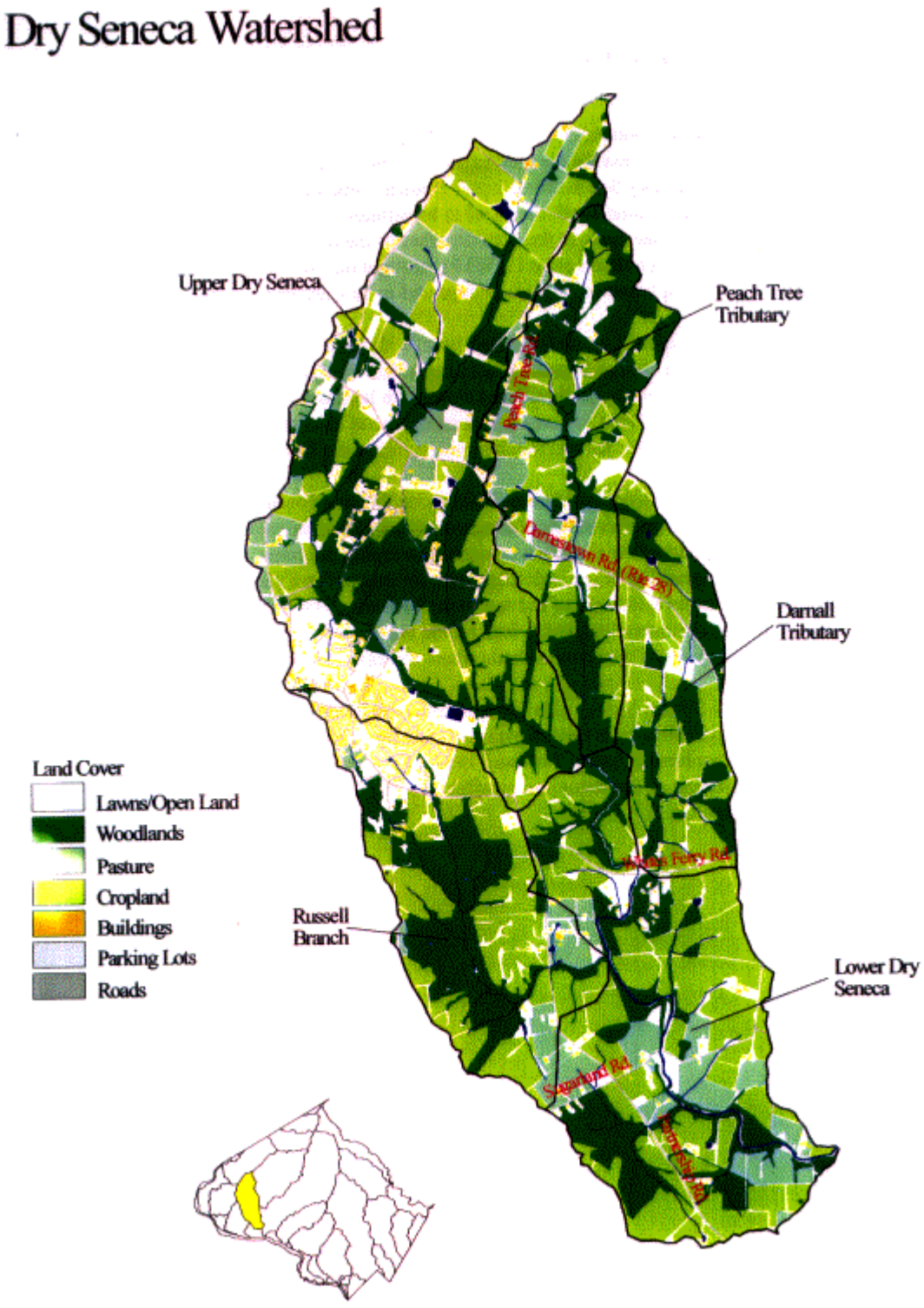


Figure 2. Land Cover Categories of Dry Seneca Watershed.

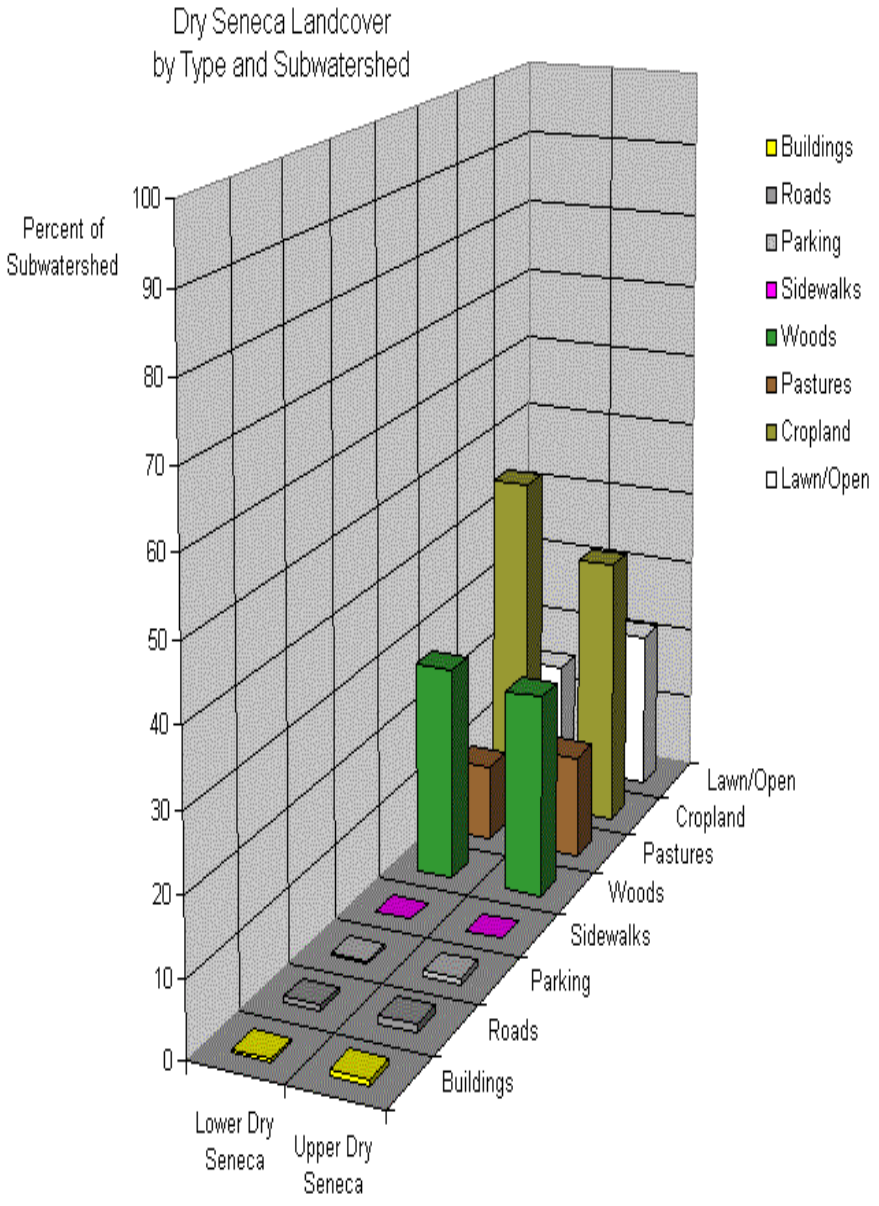


Figure 3. Land Cover by Type and Subwatershed of Dry Seneca.

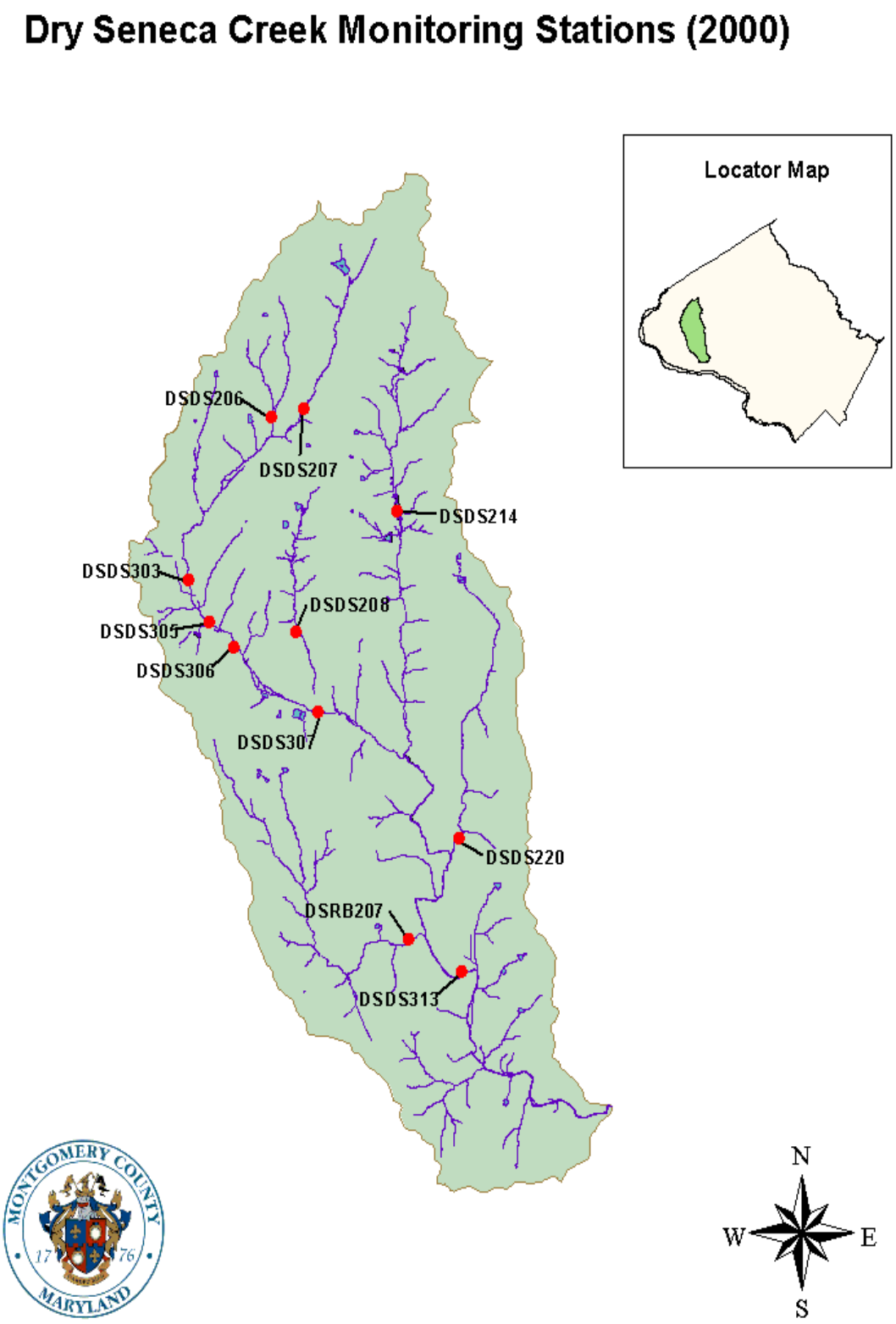


Figure 4. 2000 Dry Seneca Creek Monitoring Stations.

## *III. Methods*

All fieldwork, data reduction, and data analysis follow the stream monitoring protocols described in Van Ness et al., 1997. The overall stream condition was determined by assessing the cumulative impacts that occurred in the watershed as indicated by the use of an interim Index of Biological Integrity (IBI) for freshwater fish and benthic macroinvertebrates. The stream condition was made by examining the trends expressed by the two fauna IBI's. This is not the same as averaging the two scores. Seasonal trends were examined and a yearly stream condition has been established for the subwatersheds.

Assuming that water quality is constant throughout the study area, the relationship between habitat quality and biological condition can be predictable (Plafkin et al., 1989) and provide diagnostic information on stressors likely responsible for identified impairment to the existing stream area. Possible causes of impairment can be determined by examining the relationship between the IBI score and habitat score for each individual monitoring station (Figure 5).

Percentage of the best attainable biological condition was calculated for each IBI score and compared against percentage of the best attainable instream physical habitat in order to assess relationships between habitat and biology and identify areas of stream impairment from other than physical stressors (Figure 5). The theoretical regression lines shown in Figure 5 describe the general relationship of biological condition to habitat quality in the absence of water quality effects. The highest possible IBI score for fish is 50 (100%), for benthic macroinvertebrates 40 (100%). Abiotic factors such as water temperature, water chemistry, and analysis of both qualitative and quantitative physical habitat attributes are also used to assess the types of stressors that may be affecting the system. Impaired sites are then targeted, and further investigations of the probable causes of impairment are scheduled.

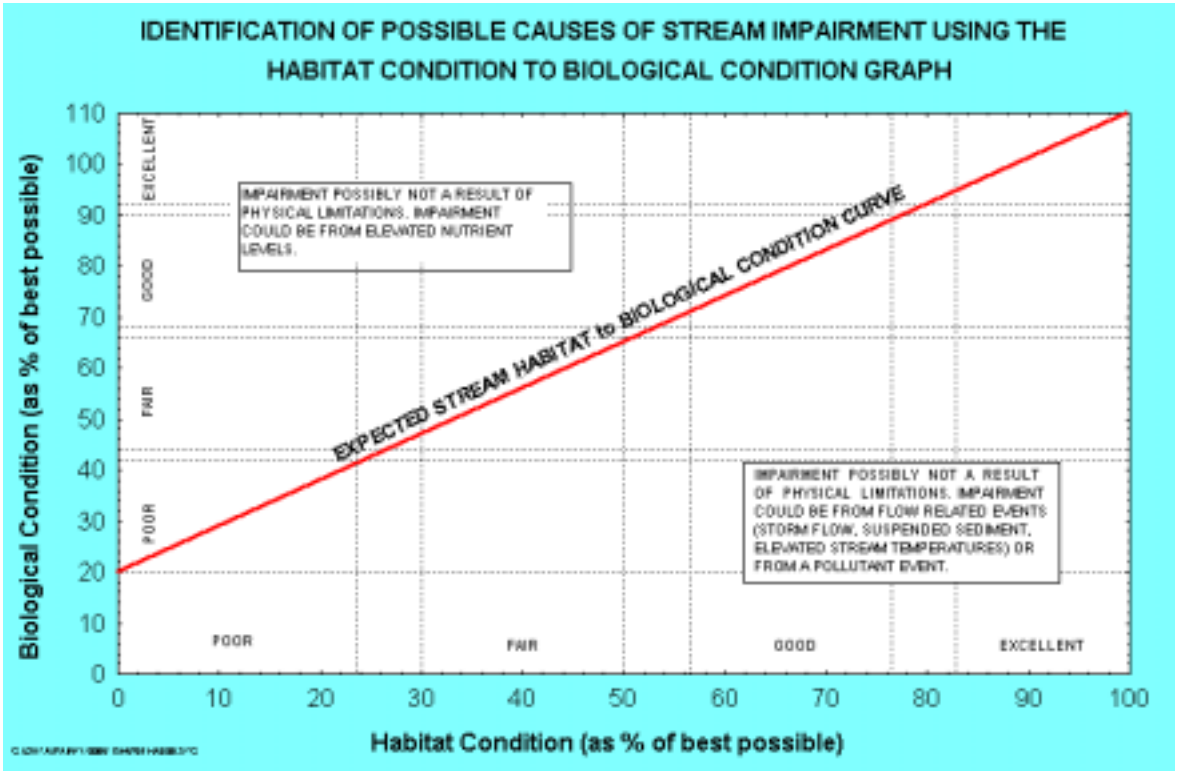

Figure 5. Expected Stream Habitat to Biological Condition Curve.

## *IV. Results*

### *A. Examination of IBI/Habitat Relationships*

The relationship of the IBI scores to the stream habitat assessment conducted when the faunal group was monitored can provide information on the stressors likely responsible for the existing resource condition. The graph (Figure 6) assessing the IBI to habitat relationship for fish and spring benthic macroinvertebrates depict trends useful for prioritizing a management strategy for Dry Seneca Creek.

#### *1. Fish IBI vs. Habitat*

Comparing fish IBI scores to habitat scores for the Dry Seneca watershed (Figure 6) shows that a majority of the stations fall **below** the expected stream habitat to biological condition curve. Four stations (DSDS313, DSRB207, DSDS207, and DSDS208) fall in the category of an "unimpaired stream", containing a "good" habitat rating with a corresponding "good" fish IBI rating. Two stations (DSDS307, and DSDS206) border an "impaired" situation, scoring a "good" habitat rating with a corresponding "fair" fish IBI rating. The remaining five stations (DSDS220, DSDS214, DSDS303, DSDS305, and DSDS306) fall in the "impaired" category, having a "good" habitat rating and a high "poor" to low "fair" fish IBI rating.

#### *2. Macroinvertebrate IBI vs. Habitat*

Comparing macroinvertebrate IBI scores to habitat scores for the Dry Seneca watershed (Figure 6) shows that a majority of the stations fall **on or above** the expected stream habitat to biological curve. Seven stations (DSDS303, SDS305, DSDS207, DSDS206, DSDS208, DSDS220, and DSDS306) fall in the category of an "unimpaired stream", containing a "good" to "excellent" habitat rating with a corresponding "good" to "excellent" macroinvertebrate IBI rating. Two stations (DSDS313, and DSRB207) border an "impaired" situation, scoring a "good" habitat rating with a corresponding "fair" macroinvertebrate IBI rating. The remaining two stations (DSDS307, and DSDS214) fall in the "impaired" category, having a "good" habitat rating and a "poor" macroinvertebrate rating.

#### **3.** *Fish and Macroinvertebrate IBI vs. Habitat*

When comparing both faunal groups to habitat (Figure 6), two stations (DSDS214, and DSDS307) fall out as being in the extremely "impaired" category, and are far below the expected stream habitat to biological curve. Station DSDS214 averages the lowest raw habitat score, and has a "poor" IBI rating for both fish and macroinvertebrates. Station DSDS307 averages the second lowest raw habitat score, and has a "poor" macroinvertebrate IBI rating, and a "fair" fish IBI rating. All other Dry Seneca stations have at least one faunal group that is designated in the "unimpaired" category, and overall falls within or near the expected stream habitat to biological curve when comparing both faunal groups to habitat.

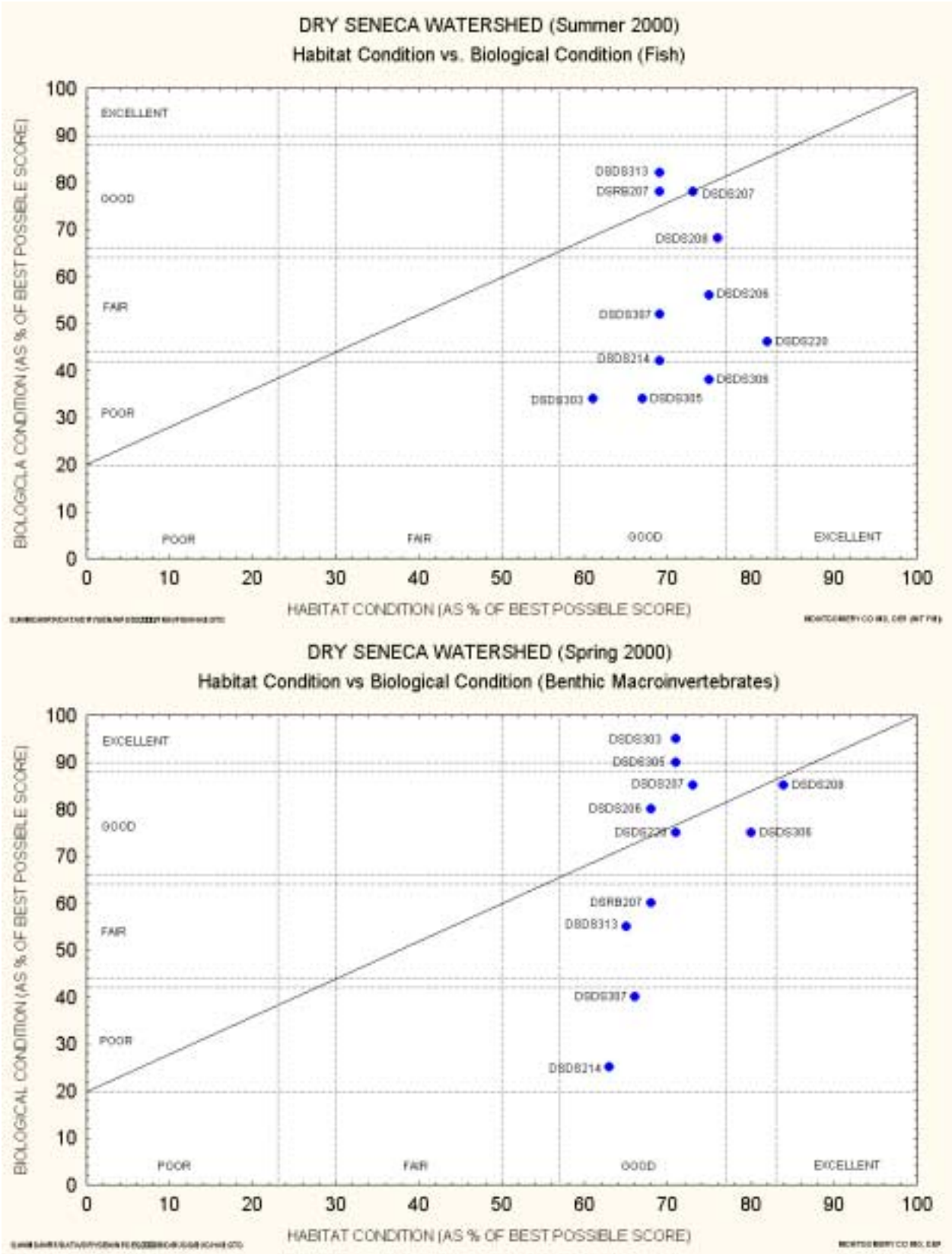


Figure 6. Relationship between habitat condition and biological condition in the Dry Seneca Creek Watershed.

***B. Water Chemistry***

Table 1 shows the water chemistry data that was collected using a Hydrolab multiprobe during our spring and summer monitoring seasons. Nine of the eleven Dry Seneca stations fell within normal ranges for water chemistry data. The station DSDS214 had low dissolved oxygen (5.6 ppm) and low percent saturation of dissolved oxygen (61%) during the summer sampling period only. Station DSDS313 had an above normal conductivity (437 µs) during the fall sampling period only. All other water chemistry parameters for these two stations were in the normal range.

Table 1. Water Chemistry Data from Dry Seneca Monitoring Stations

| Station | Date | Dissolved Oxygen (ppm) | Percent Saturation | PH | Conductivity (umhos) | Air Temperature (Degrees Celsius) | Water Temperature (Degrees Celsius) |
|---|---|---|---|---|---|---|---|
| DSDS206 | 04/27/2000 | 10.54 | 92 | N/A | 127 | 11 | 10.39 |
| | 06/21/2000 | 7.83 | 78 | 8.00 | 136 | 21 | 16.30 |
| DSDS207 | 06/21/2000 | 8.13 | 86 | 8.00 | 78 | 23 | 18.12 |
| DSDS208 | 04/05/2000 | 12.09 | 100 | 7.28 | 79 | 7 | 7.92 |
| | 06/14/2000 | 9.80 | 100 | 7.33 | 108 | N/A | 17.65 |
| DSDS214 | 04/27/2000 | 10.37 | 89 | 8.18 | 94 | 11 | 10.66 |
| | 06/13/2000 | 5.60 | 61 | 7.84 | 133 | N/A | 20.58 |
| DSDS220 | 04/27/2000 | 10.97 | 95 | N/A | 216 | 11 | 10.12 |
| | 06/29/2000 | 8.09 | 86 | 8.37 | 300 | 22 | 19.18 |
| DSDS303 | 03/31/2000 | 10.47 | 97 | 7.58 | 100 | 14 | 12.91 |
| DSDS305 | 04/21/2000 | 9.80 | 155 | 6.99 | 155 | 15 | 13.78 |
| | 06/23/2000 | 6.94 | 74 | 7.57 | 148 | N/A | 19.40 |
| DSDS306 | 04/05/2000 | 12.90 | 111 | 7.23 | 125 | 10 | 9.56 |
| DSDS307 | 04/27/2000 | 10.10 | 90 | 7.24 | 149 | 10 | 10.28 |
| | 06/23/2000 | 6.74 | 75 | 7.67 | 417 | N/A | 21.42 |
| DSDS313 | 04/10/2000 | 13.50 | 116 | 7.80 | 176 | N/A | 8.70 |
| | 10/26/2000 | 8.33 | 80 | 7.95 | 437 | N/A | 13.40 |
| DSRB207 | 04/27/2000 | 11.96 | 109 | 7.48 | 149 | 12 | 11.13 |

***C. Temperature***

Five continually recording water temperature meters were placed within the Dry Seneca Creek watershed during June of 2000, and recorded data until the end of September (Figure 7). For all five stations, stream temperatures never reached above 78 degrees F, and rarely breached the Class IV State Use Criteria designation. Overall, stream temperature does not appear to be a significant limiting factor in the Dry Seneca watershed.

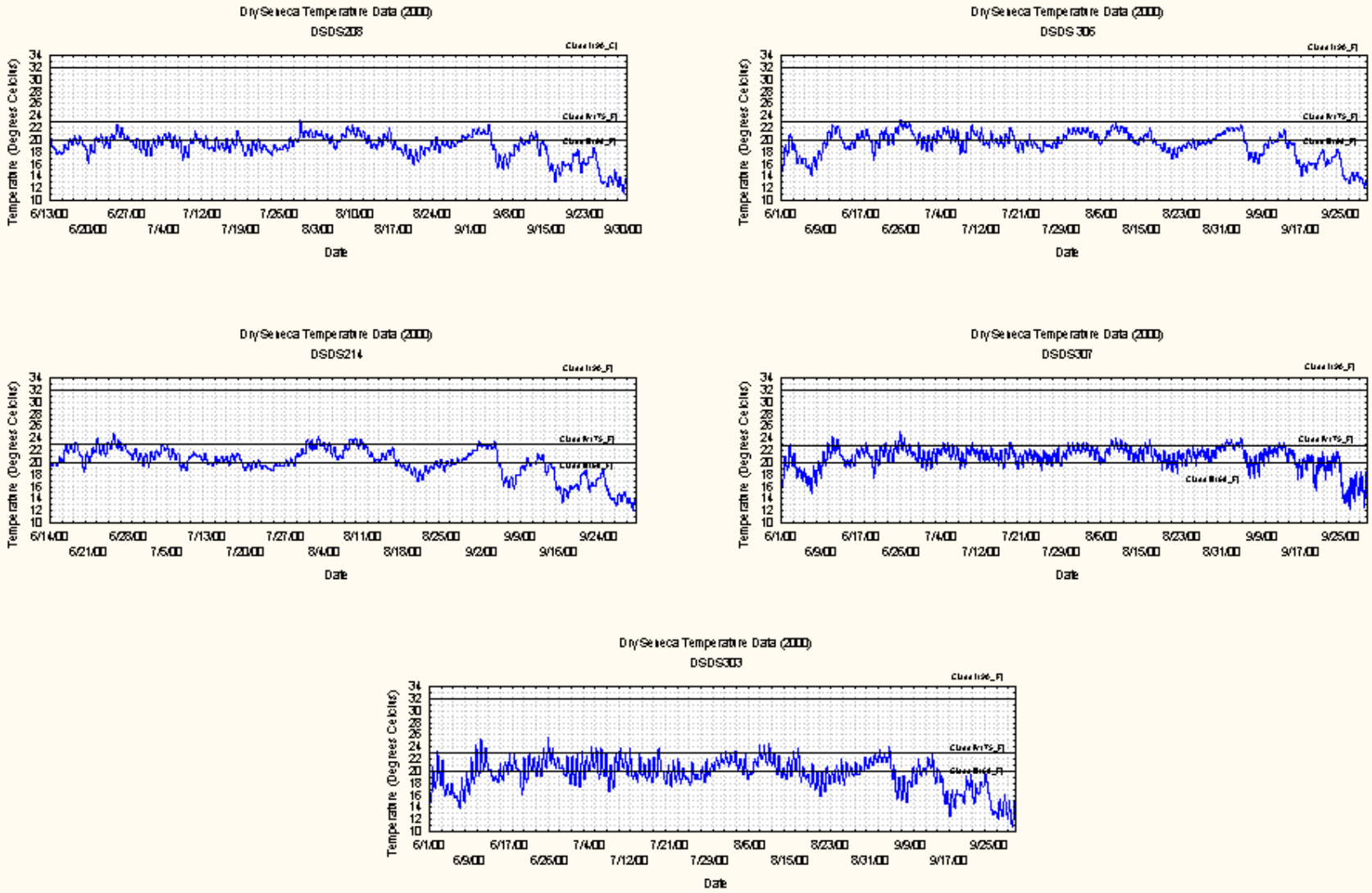


Figure 7. Water Temperature Graphs for Select Dry Seneca Stations.

***D. Habitat Analysis and Stream Morphological Measurements***

For all stations, for both monitoring seasons, most of the individual habitat parameters scored in the "good" to "excellent" range (Table 2). Five stations (DSDS206, DSDS214, DSDS303, DSDS305, and DSDS307) scored in the "fair" range for the embeddedness and sediment deposition parameters. These two parameters are correlated with each other indicating an excess of sediment in the streambed. Station DSDS214 also scored in the "fair" range for the fish cover parameter. This indicates that the instream fish habitat is below average, containing a very homogeneous stream type with little habitat diversity.

Table 2. Selected Habitat Parameters (From Rapid Habitat Assessment) of Dry Seneca Stations.

| Station | Date | Fish Cover | Epifaunal Substrate | Embedded-ness | Sediment Deposition | Riffle Frequency | Channel Flow Status | Bank Vegetation | Bank Stability |
|---|---|---|---|---|---|---|---|---|---|
| DSDS206 | 04/27/2000 | Good | Good | Fair | Fair | Excellent | Good | Good | Good |
| | 06/21/2000 | Excellent | Good | Good | Good | Good | Excellent | Good | Good |
| DSDS207 | 06/21/2000 | Good | Good | Good | Good | Good | Good | Good | Excell./Good |
| | 04/27/2000 | Good | Good | Good | Good | Excellent | Good | Good | Good |
| DSDS208 | 04/05/2000 | Excellent | Excellent | Excellent | Good | Excellent | Good | Good | Good/Excell. |
| | 06/14/2000 | Excellent | Good | Good | Fair | Excellent | Good | Good | Good |
| DSDS214 | 06/13/2000 | Good | Excellent | Fair | Fair | Good | Excellent | Good | Good |
| | 06/13/2000 | Fair | Good | Fair | Poor | Good | Good | Good | Good |
| | 04/27/2000 | Fair | Good | Fair | Fair | Good | Excellent | Good | Good |
| DSDS220 | 06/29/2000 | Good | Excellent | Good | Excellent | Excellent | Excellent | Excell./Good | Excell./Good |
| | 04/27/2000 | Good | Excellent | Poor | Good | Excellent | Excellent | Good | Good/Excell. |
| DSDS303 | 06/15/2000 | Good | Good | Fair | Fair | Good | Good | Good | Good |
| | 03/31/2000 | Good | Good | Good | Good | Good | Excellent | Good | Excell./Good |
| DSDS305 | 04/21/2000 | Good | Good | Good | Fair | Good | Good | Good | Good |
| | 06/23/2000 | Good | Good | Good | Fair | Good | Good | Good | Good/Fair |
| DSDS306 | 04/05/2000 | Good | Good | Good | Good | Excellent | Good | Excell./Good | Good/Excell. |
| | 06/15/2000 | Excellent | Excellent | Good | Good | Good | Good | Good | Good |
| DSDS307 | 04/27/2000 | Excellent | Good | Fair | Fair | Excellent | Good | Good | Good |
| | 06/23/2000 | Excellent | Good | Good | Fair | Good | Good | Good | Good |
| DSDS313 | 10/26/2000 | Good | Good | Good | Good | Good | Good | Good | Good |
| DSRB207 | 04/27/2000 | Good | Good | Fair | Good | Good | Excellent | Good | Good |

Stations DSDS303 (Figure 9), DSDS305 (Figure 10), and DSDS306 (Figure 11) are classified as "moderately entrenched" (entrenchment ratio = 1.41 to 2.2) with fairly high banks that prevent access of high flow events to their floodplain, and a deep thalweg in the stream channel. Station DSDS208 (Figure 8) can be classified as "slightly entrenched" (entrenchment ratio = 2.2+), having one high bank that allows for an active floodplain on only one side of the stream (Rosgen, 1996).

Stations DSDS208 (Figure 12), DSDS305 (Figure 13), and DSDS306 (Figure 15) have a pebble density D50 of medium gravel to course gravel, and a D84 of course gravel to very course gravel. Station DSDS303 (Figure 14) has a D50 of course gravel to very course gravel, and a D84 of very course gravel to small cobble (Rosgen, 1996). These density ranges are below optimal, but cannot be designated as an impairment or problem.

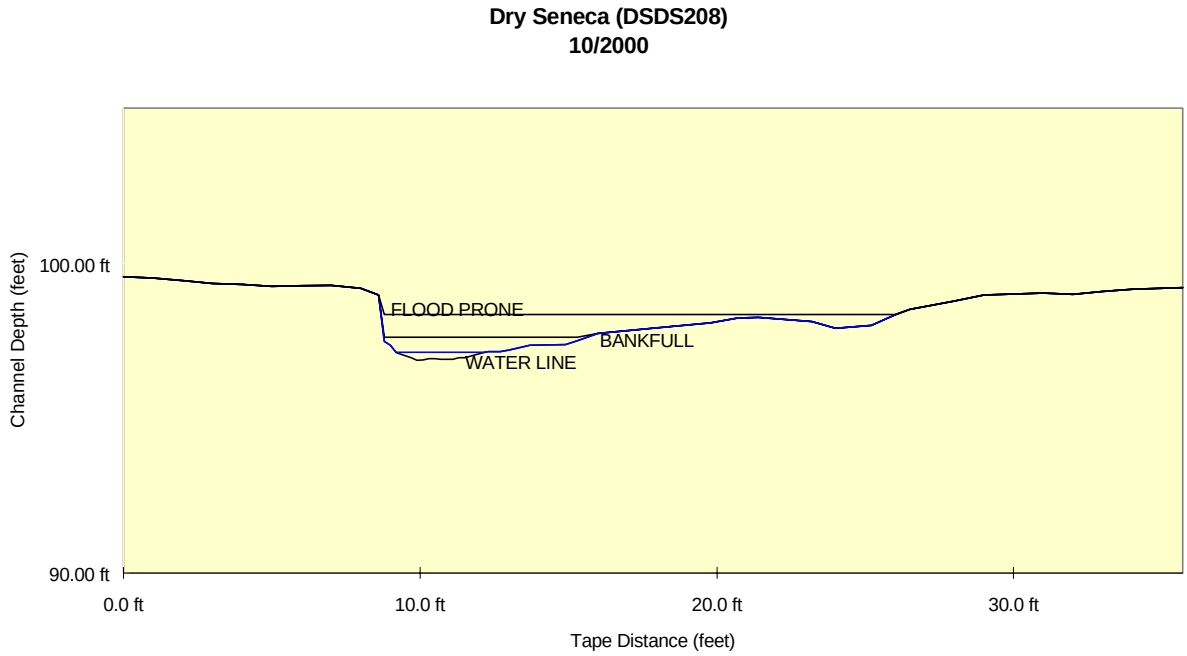


Figure 8. Stream cross section from station DSDS208.

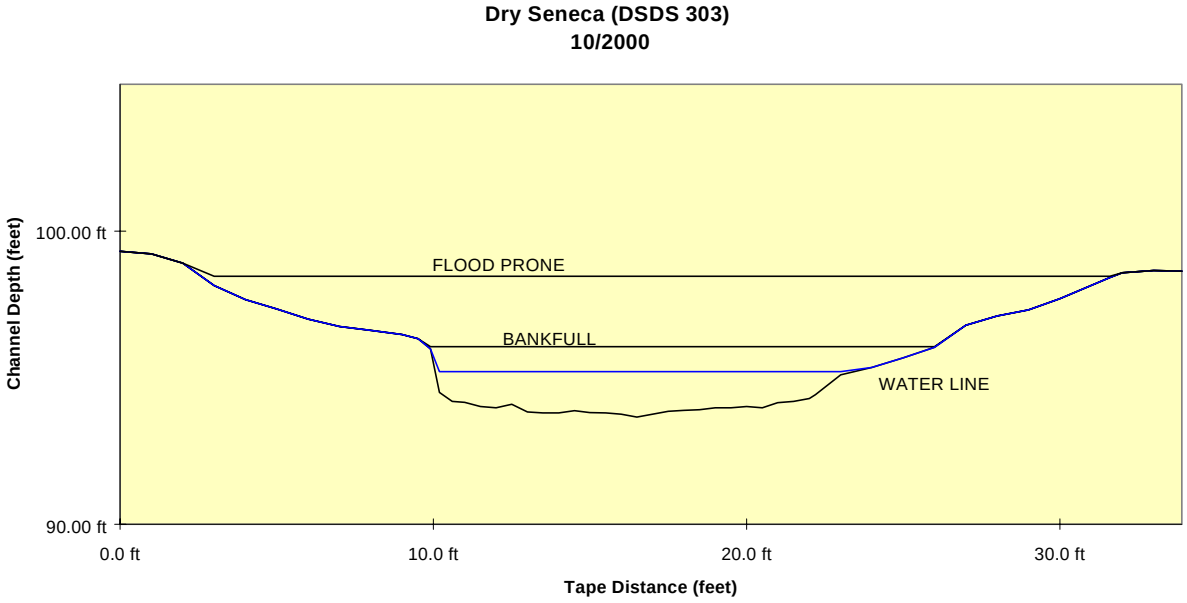


Figure 9. Stream cross section from station DSDS303.

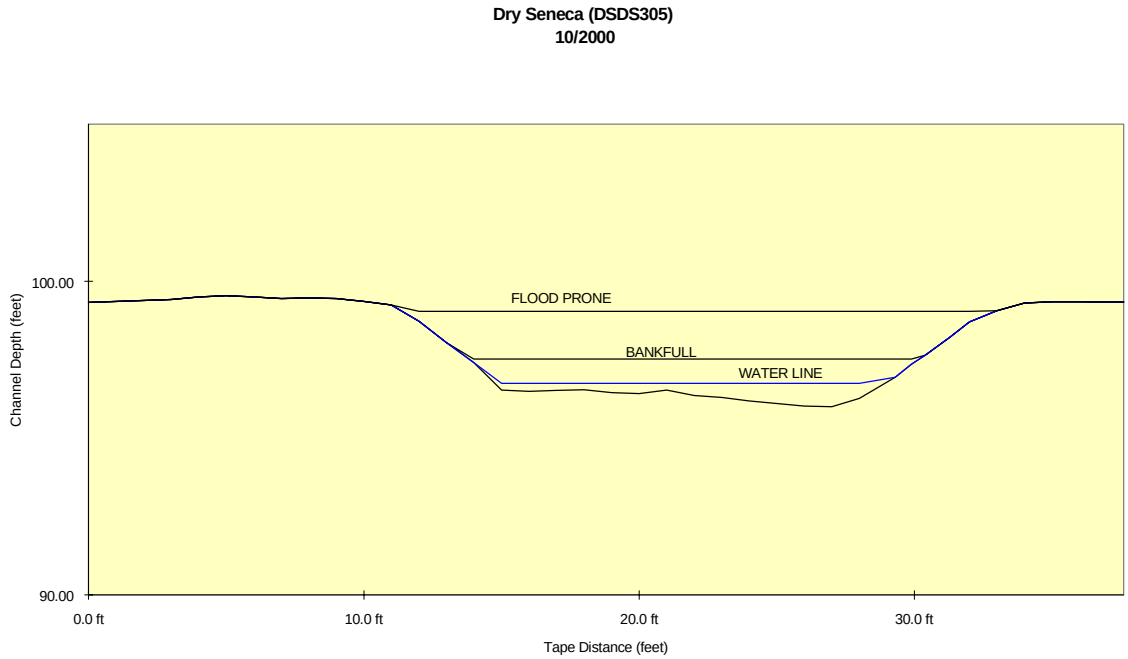


Figure 10. Stream cross section from station DSDS305

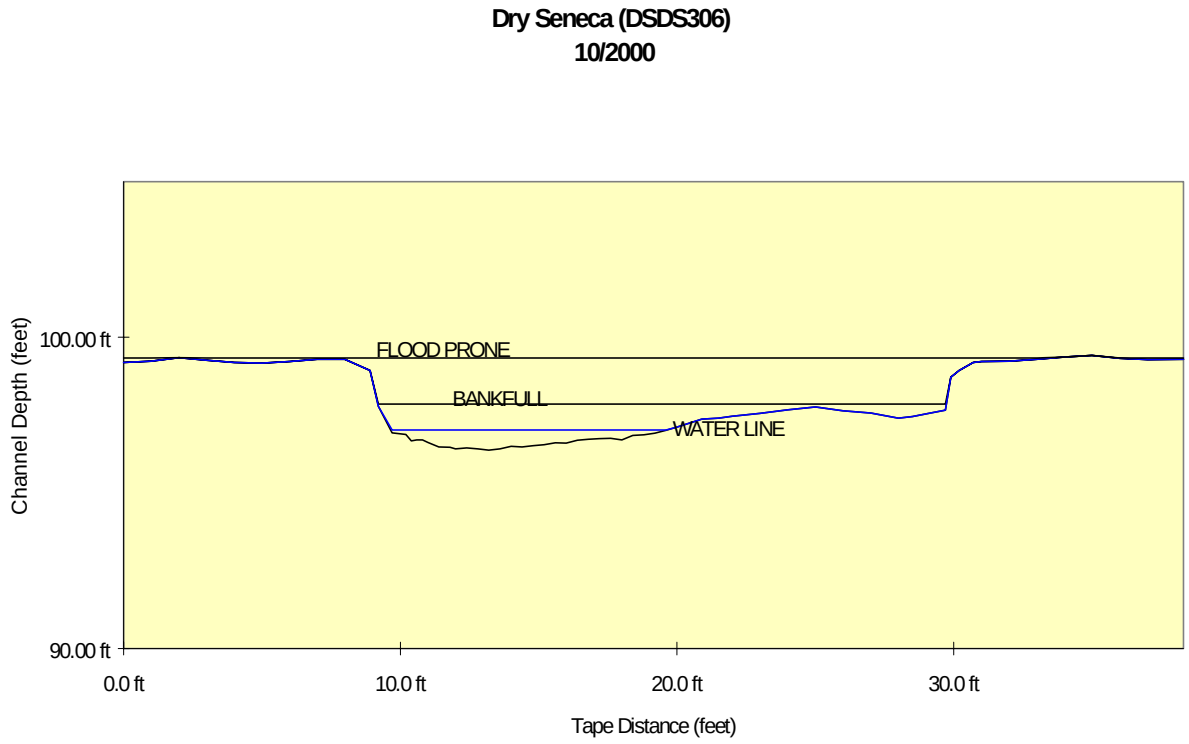


Figure 11. Stream cross section from station DSDS306.

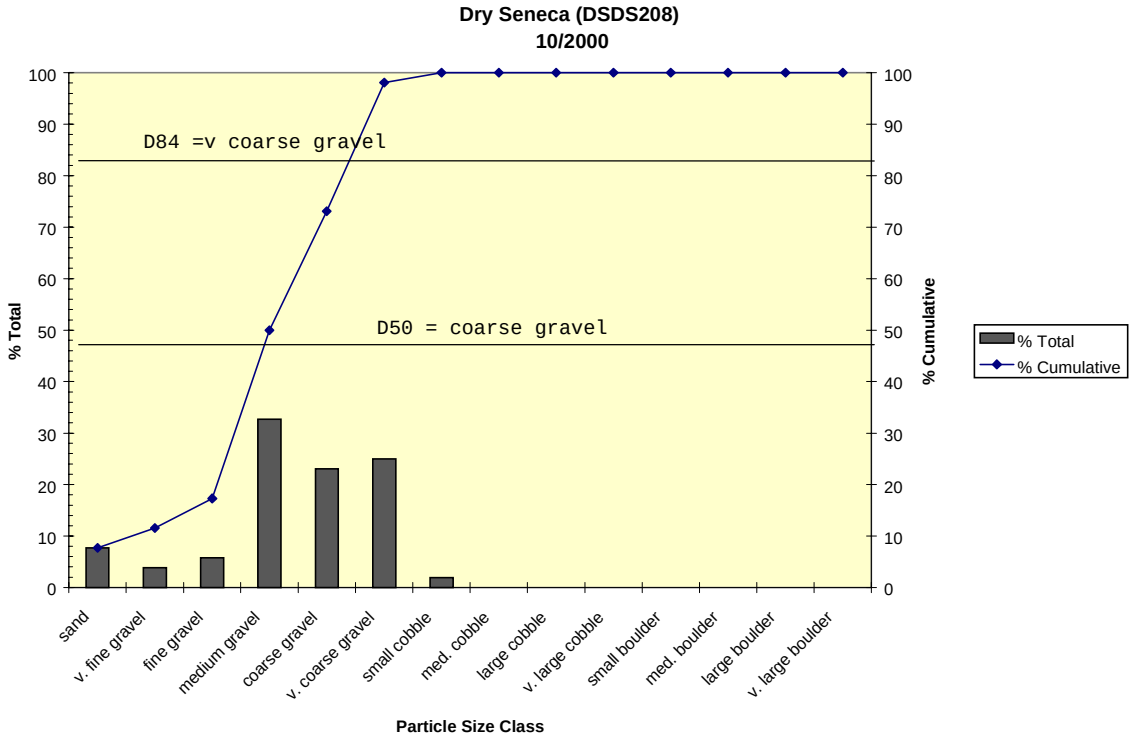


Figure 12. Particle size class distribution for station DSDS208.

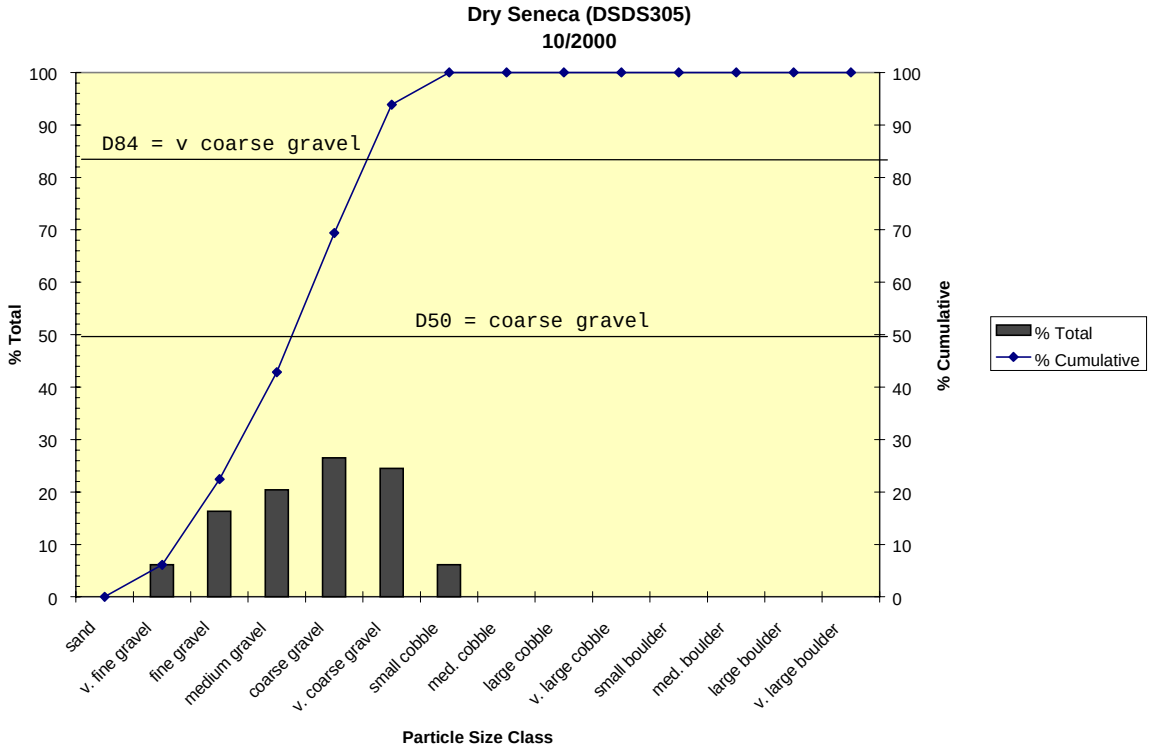


Figure 13. Particle size class distribution for station DSDS305

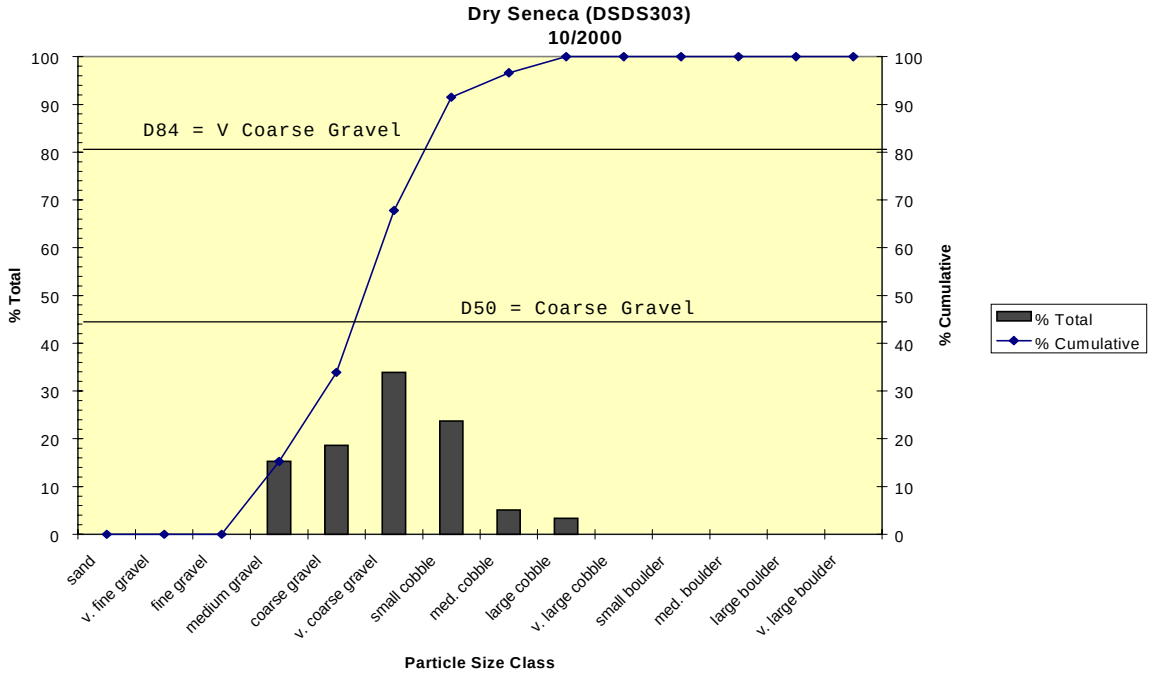


Figure 14. Particle size class distribution for station DSDS303

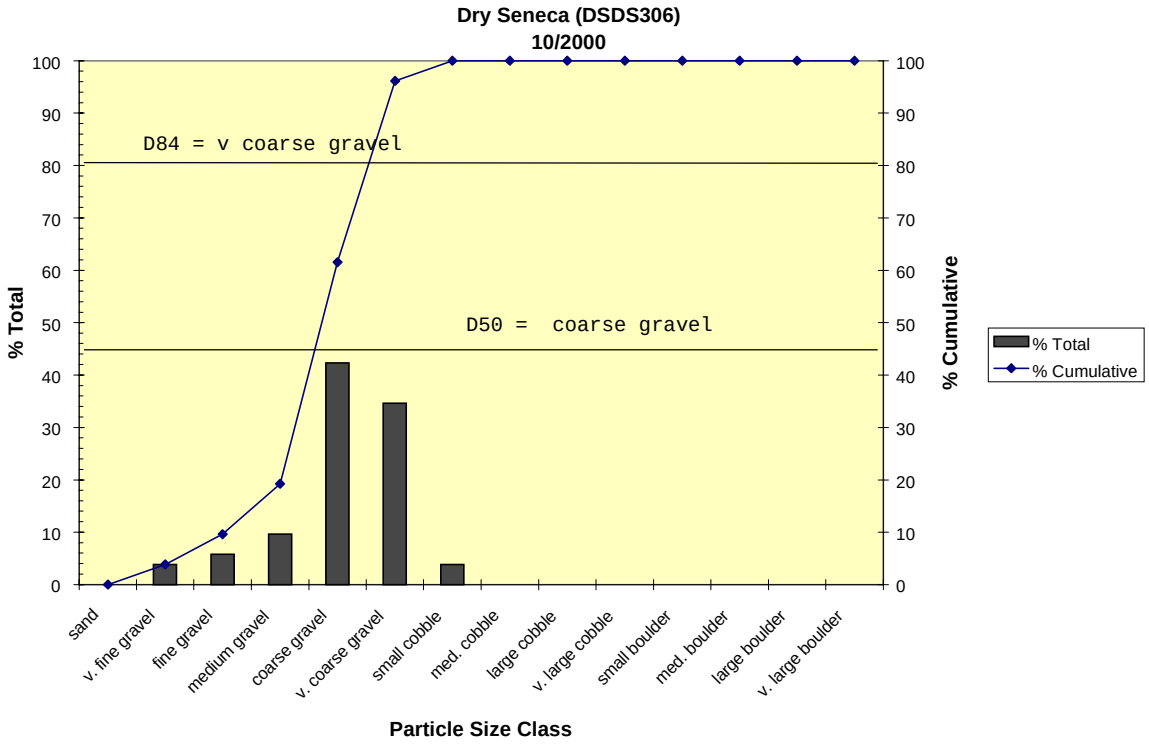


Figure 15. Particle size class distribution for station DSDS306

## *V. Discussion*

Analyzing the two faunal groups that were collected at the various stations in Dry Seneca Creek produce varying results. Most stations (7 out of 11) scored in the "fair" to "poor" range for fish, but those same stations scored in the "good" to "excellent" range for macroinvertebrates. This most likely points to the conclusion that the drought from the summer of 1999 is still impacting the fish community. Many observations were made, and documented, during the summer of 1999 that showed watersheds larger than Dry Seneca which were completely dry at the confluence with the Potomac River. The fish populations of the Dry Seneca stations that scored poorly were mostly dominated by "pioneering species" (Table 3). This can indicate that these stations were previously dry, and that these "pioneering species" are the first species beginning to repopulate the stream. Thus, the fish IBI scores may not be as indicative of water quality as it is of recovery from drought. Maroinvertebrates were not as affected by drought events, and may be a better indicator of the true water quality of the Dry Seneca watershed.

Further analyzing the macroinvertebrate IBI scores depicts a noticeable trend. The scores become considerably worse as one moves down the Dry Seneca mainstem through the town of Poolesville, and then the IBI score recuperates farther downstream as it enters parkland (Figure 16). This degradation of macroinvertebrate IBI scores could be from the impacts of past development and the corresponding increased imperviousness in the drainage area.

When analyzing all collected data for all stations, the station DSDS307 and station DSDS214 can be classified as "impaired". DSDS307 is most likely affected by runoff from the town of Poolesville, and the Poolesville WWTP outfall located approximately 100 meters upstream of the station. Water quality seems to be the reason for this "impaired" designation. When sampling this station during the spring index period, biologists noticed obvious evidence of untreated municipal water in the stream system, and a strong odor of sewage. It is recommended that further water quality analysis be performed on the WWTP outfall and downstream area.

Station DSDS214 is designated as "impaired" and is most likely a result of the current land use practices in the drainage area. The Lewis Orchards property is located within, and upstream of the station. Observation and individual habitat parameters indicate an excess of sediment in the stream, which may be discharging from a large farm pond on the Lewis property. Sediment may have accumulated in this pond throughout the years and is now being discharged at a rapid rate into the stream during storm events. This impact probably explains the poor biology and habitat recorded at this station. It is recommended that this problem be sent to NRCS, so a DEP biologist and NRCS staff member can further investigate the site to determine the severity of the problem, and identify possible solutions. Low dissolved oxygen and percent saturation levels were recorded during the spring sampling period, which can be further tested during the 2001 sampling season

Overall, most stations in the Dry Seneca watershed are not "impaired", and can be classified in the "good" condition. Besides the aforementioned stations, the only major water quality and quantity stressor seems to be the impacts from the drought of 1999. No stations sampled are **severely** entrenched, eroded, or void of instream fish or macroinvertebrate habitat that renders stream restoration. Of the stations that were monitored for temperature, no stations exceeded normal summer temperature ranges.

Table 3: Percentage of Fish Pioneering species for Dry Seneca Creek Stations.

| Station | Total # of Species | Total # of Individuals | % Pioneering |
|---|---|---|---|
| DSDS206 | 9 | 189 | 80% |
| DSDS207 | 9 | 523 | 60% |
| DSRB207 | 8 | 207 | 51% |
| DSDS208 | 6 | 202 | 73% |
| DSDS214 | 4 | 286 | 94% |
| DSDS220 | 8 | 181 | 86% |
| DSDS303 | 9 | 198 | 80% |
| DSDS305 | 13 | 175 | 83% |
| DSDS306 | 15 | 197 | 62% |
| DSDS307 | 15 | 161 | 44% |
| DSDS313 | 15 | 420 | 27% |

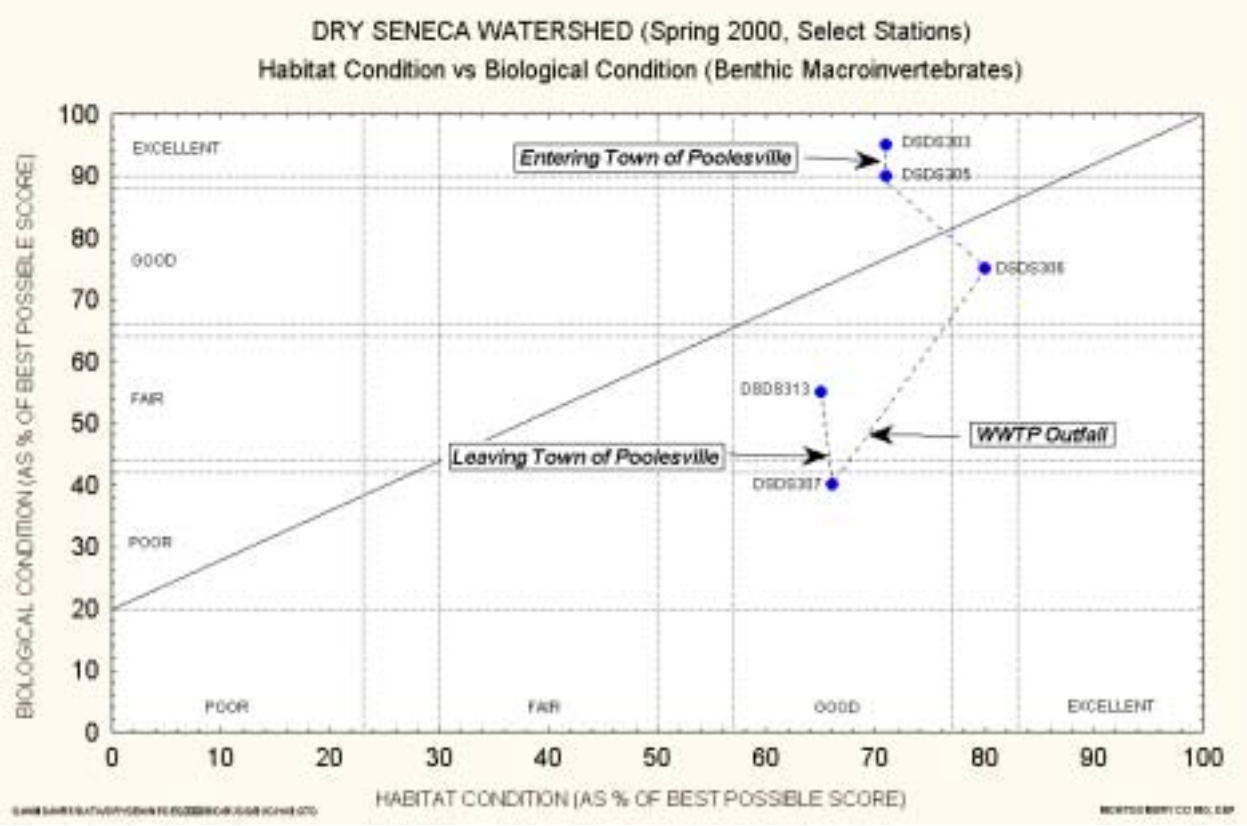


Figure 16. Macroinvertebrate IBI scores for Dry Seneca Creek mainstem stations, identifying Poolesville Town limits.

## *VI. Literature Cited*

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